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PATENT
674556-2004

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant(s)	:	CHOY and CHANG
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Examiner	:	Sean E. Vincent
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APPEAL BRIEF AND REQUEST FOR EXTENSION OF TIME

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Sir:

INTRODUCTION

This is an Appeal from the June 9, 2003 Final Rejection by the Examiner, finally rejecting claims 29-56. The Notice of Appeal was received by the Patent and Trademark Office on December 12, 2003, setting the deadline for filing an Appeal Brief as February 12, 2004. Pursuant to 37 C.F.R. §§1.136(a) and 1.1 7(a), it is respectfully requested that the period for filing the Appeal Brief be extended one month, i.e., up to and including March 12, 2004.

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This Brief is submitted in triplicate as required by 37 C.F.R. §1.192(a) and is accompanied by the requisite fee set forth in 37 C.F.R. §1.17(c) of $165.00 for a small entity; along with the requisite fee of $55.00 for the extension of time, and the Commissioner is hereby authorized to charge any additionally required fee for this Brief, or occasioned by this paper, or credit any overpayment in such a fee, to Deposit Account No. 50-0320.

RELIEF REQUESTED

It is respectfully requested that the rejection of claims 29-52 be reconsidered and withdrawn, and that a Notice of Allowance promptly issue.

REAL PARTY IN INTEREST

The real party in interest is Innovative Materials Processing Technologies Limited, having an address of: 90 Fetter Lane, London, Great Britain, EC4A 1JP.

RELATED APPEALS AND INTERFERENCES

Upon information and belief, the undersigned attorney does not believe that there is any appeal or interference that will directly affect, be directly affected by or have a bearing on the Board's decision in the pending appeal.

STATUS OF THE CLAIMS

Claims 29-56 as set forth in Appendix A hereto (Exhibit A), are rejected under 35 U.S.C. §103(a) as unpatentable over Choy *et al.* (WO 97/21848) in view of Blackwell *et al.* (U.S. Patent 6,312,656).

STATUS OF THE AMENDMENTS

Appellants believe that all the Amendments and papers submitted prior hereto have been entered.

SUMMARY OF THE INVENTION

The present invention involves a method of depositing material on a substrate, comprising the steps of: delivering from a first outlet a stream of droplets of a precursor liquid towards a substrate; applying an electric field between the first outlet and the substrate; and delivering from a second outlet a flow of fuel about the stream of droplets such as to provide an annular flame combustion region between the first outlet and the substrate through which at least a portion of the stream of droplets passes before reaching the substrate, whereby the precursor liquid is chemically reacted, or decomposed, or chemically reacted and decomposed, to provide

the deposited material, as set forth in claim 29, one of two independent claims and upon which claims 30-44 depend either directly or indirectly.

The present invention also involves an apparatus for depositing material on a substrate, comprising: a nozzle assembly including a first outlet from which a stream of droplets of a precursor liquid is in use delivered to a substrate, and a second outlet from which a flow of fuel is in use delivered such as to provide an annular flame combustion region through which at least a portion of the stream of droplets in use passes before reaching the substrate; a precursor supply for supplying a precursor liquid to the nozzle assembly; an electrical supply for applying an electric field between the first outlet and the substrate; and a burner for generating the flame of the annular flame combustion region between the first outlet and the substrate; whereby the precursor liquid is chemically reacted, or decomposed, or chemically reacted and decomposed, in the annular flame combustion region to provide the deposited material, as set forth in claim 45, the second of two independent claims, and upon which claims 46-56 depend either directly or indirectly.

All of claims 29-56 require the presence of an annular flame combustion region between the first outlet and the substrate.

The embodiments of the claims of the present application are patentable over Choy *et al.* (WO 97/21848) in view of Blackwell *et al.* (US 6,312,656).

ISSUE PRESENTED

Whether claims 29-56 that are clearly patentable over Choy *et al.* (WO 97/21848) in view of Blackwell *et al.* (US 6,312,656), should be allowed as there is no teaching or suggestion of the claimed methods and apparatus including an annular flame combustion region especially when:

- Choy *et al.* is directed to an apparatus and method which requires an increasing temperature gradient between the outlet (5) and the substrate (14), as disclosed in the summary of the invention at page 1, lines 22 to 30, particularly lines 29 and 30;
- Blackwell *et al.* is directed to a combustion region; and,
- Blackwell *et al.* discloses the delivery of fuel through an annular outlet, this being the outlet defined by the outermost channel (47); the outermost channel (47) being a frusto-conical channel and not a cylindrical channel; wherein the channels (43-47) are concentric (column 9, lines 6 and 7), meaning that the channels (43-47) have a common

center; and wherein the outermost channel (47), in being a frusto-conical channel, **manifestly cannot provide for the generation of an annular flame combustion region**; and,

- there is no teaching, suggestion or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at the recitations of dependent claims 30-44 and 46-56.

In short, and as fully discussed below, Applicants answer the foregoing question in the affirmative, i.e., Appellants respectfully assert that there is NO support for an obviousness rejection and that the claims are patentable over Choy *et al.* (WO 97/21848) in view of Blackwell *et al.* (US 6,312,656); and, that the rejection of the present application should be reconsidered and withdrawn, and that claims 29-56 should be allowed, with such relief also respectfully requested.

GROUPING OF CLAIMS

The Claims Do Not Stand Or Fall Together

For purposes of this appeal, claims 29-56 each constitute a separate invention, i.e. claims 29-56 do not stand or fall together.

It is respectfully requested that each and every recitation of each and every claim be fully considered in assessing patentability.

More specifically, claim 29 is directed to a method of depositing material on a substrate, whereby the precursor liquid is chemically reacted and/or decomposed to provide the deposited material.

Claim 30 of the instant application involves a distinct species within claim 29; namely, that the checmical reaction and/or decomposition occurs in a higher temperature overlap zone. Nothing in the prior art teaches that the recitation of claim 30 is inherent within claim 29.

Similarly, claims 31, 32, 33 similarly involve distinct species within claim 29. Again, there is no teaching in the prior art that requires the flow of fuel to be a diverging flow, or that the first and second outlets must be coaxial, or that the stream of droplets is a diverging spray. In fact, various material deposition methods would require that none of the recitations of claims 31, 32 and 33 be present.

Moreover, claim 34 and the claims dependent thereon (claims 35, 36), involve a distinct species within a flow of cold gas is delivered in a direction towards the substrate from the first outlet. Such a flow of cold gas is clearly not encompassed within claim 29, such that claims 34-36 should not stand or fall with claim 29, or any of the claims dependent on claim 29.

Furthermore, claim 35 specifies that the cold gas flow is delivered from a third outlet, which clearly is not encompassed within claim 34 and is thereby distinct from claim 34. Similarly, claim 36 also requires a third outlet, thereby rendering claim 36 distinct from claim 34. However, claim 36 also designates that the arrangement of the outlets must be such that outlets 1 and 3 are coaxial, a restriction not suggested by either claim 34 or the prior art.

Claim 37 requires that the material being deposited is a ceramic. Claim 29 clearly encompasses deposition of a variety of materials, accordingly, claim 37 is a distinct species from claim 29. Similarly, claim 38 requires that the material being deposited is a multicomponent oxide material, and is accordingly also distinct from claim 29.

Additionally, claims 39, 41, and 42 introduce additional steps to the method of claim 29, steps which clearly are not encompassed within claim 29, nor are taught in the art as required to practice the method of claim 29. Accordingly, claims 39, 41 and 42 also are distinct species from claim 29.

Claim 40 requires that the precursor liquid is a sol precursor solution. Claim 29 clearly encompasses deposition of a variety of materials using the appropriate variety of precursor liquids, accordingly, claim 40 is a distinct species from claim 29.

Each of claims 43 and 44 introduces a limitation into the form of the material when deposited, either as a powder or as a solid film, respectively. Claim 29 clearly encompasses deposition of a variety of materials in a variety of forms, and the prior art does not specify a single form in which material must be deposited; accordingly, claims 43 and 44 are distinct species from claim 29.

Claim 45 provides an apparatus for depositing material on a substrate, whereby the precursor liquid is chemically reacted and/or decomposed to provide the deposited material.

Claim 46, in a manner similar to claim 30 and claim 29, involves a distinct species within claim 45; namely, that the checmical reaction and/or decomposition occurs in a higher temperature overlap zone. Nothing in the prior art teaches that the recitation of claim 46 is inherent within the apparatus claim 45.

Additionally, claim 47 similarly involves a distinct species within claim 45. Again, there is no teaching in the prior art that requires the first and second outlets to be coaxial. Accordingly, claims 47 is distinct from claim 45.

Moreover, claim 48 and the claim dependent thereon (claims 49), involve a distinct species within a flow of cold gas is delivered in a direction towards the substrate from the first outlet from a third outlet disposed between the first and second outlets. Such a flow of cold gas is clearly not encompassed within claim 45, such that claims 48 and 49 should not stand or fall with claim 45, or any of the claims dependent on claim 45. Furthermore, claim 49 requires that outlets 1 and 3 are coaxial, a restriction not suggested by either claim 45 or the prior art, thereby rendering claim 49 distinct from claim 45.

Claim 50 introduces a new limitation on the apparatus of claim 45, requiring that the first outlet be a central outlet. Clearly, the apparatus of claim 45 does not necessitate that the first outlet be a central outlet, nor does the prior art teach that such a limitation be required. Accordingly, claim 50 is a distinct species from claim 45.

Furthermore, claims 51, 52 and 54 provide additional elements to the apparatus of claim 45. The apparatus of claim 45 does not require the additional elements of claims 51, 52 and 54, nor does the prior art teach that these additional elements be present in an apparatus such as that of claim 45, thereby rendering claims 51, 52 and 54 distinct species from claim 45.

Claim 53 introduces a new limitation to claim 52, requiring that the electrode be an annular electrode. The apparatus of claim 52 is functional regardless of whether or not the electrode is an annular electrode, thereby demonstrating that claim 53 is a distinct species from claim 52.

Each of claims 55 and 56 introduces a limitation into the form of the material when deposited, either as a powder or as a solid film, respectively. Claim 45 clearly encompasses an apparatus for deposition of a variety of materials in a variety of forms, and the prior art does not specify a single form in which material must be deposited; accordingly, claims 55 and 56 are distinct species from claim 45.

Accordingly, claims 29-56 do not stand or fall together; and, it is respectfully requested that each of these claims be considered individually, and that each and every recitation of each of the pending claims be considered in assessing the patentability of each of these claims individually and separately.

ARGUMENT

THE REJECTION OF ALL CLAIMS UNDER 35 U.S.C. §103 IS OVERCOME

There is no prima facie obviousness between the instant claims and Choy et al. in combination with Blackwell et al.

The instant invention is directed to, *inter alia*, methods of depositing material on a substrate, comprising the steps of delivering from a first outlet a stream of droplets of a precursor liquid towards a substrate; applying an electric field between the first outlet and the substrate; and delivering from a second outlet a flow of fuel about the stream of droplets such as to provide an annular flame combustion region between the first outlet and the substrate through which at least a portion of the stream of droplets passes before reaching the substrate, whereby the precursor liquid is chemically reacted, or decomposed, or chemically reacted and decomposed, to provide the deposited material. The present invention is also directed to apparatus for depositing material on a substrate, comprising: a nozzle assembly including a first outlet from which a stream of droplets of a precursor liquid is in use delivered to a substrate, and a second outlet from which a flow of fuel is in use delivered such as to provide an annular flame combustion region through which at least a portion of the stream of droplets in use passes before reaching the substrate; a precursor supply for supplying a precursor liquid to the nozzle assembly; an electrical supply for applying an electric field between the first outlet and the substrate; and a burner for generating the flame of the annular flame combustion region between the first outlet and the substrate; whereby the precursor liquid is chemically reacted, or decomposed, or chemically reacted and decomposed, in the annular flame combustion region to provide the deposited material.

In order to ground an obviousness rejection, there must be some teaching which would have provided the necessary incentive or motivation for modifying the reference's teaching. *In re Laskowski*, 12 U.S.P.Q. 2d 1397, 1399 (Fed. Cir. 1989); *In re Obukowitz*, 27 U.S.P.Q. 2d 1063 (B.P.A.I. 1993). Further, "obvious to try" is not the standard under 35 U.S.C. §103. *In re Fine,* 5 U.S.P.Q. 2d 1596, 1599 (Fed. Cir. 1988). And as stated by the Court in *In re Fritch*, 23 U.S.P.Q. 2d 1780, 1783-1784 (Fed. Cir. 1992): "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggests the desirability of the modification." Also, the Examiner is respectfully

reminded that for the Section 103 rejection to be proper, both the suggestion of the claimed invention and the expectation of success must be founded in the prior art, and not Applicants' disclosure. *In re Dow*, 5 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1988).

It is respectfully submitted that the combination of Choy *et al.* and Blackwell *et al.* do not render the present invention obvious, i.e. Choy *et al.* and Blackwell *et al.* do not combine to provide methods of depositing material on a substrate, comprising the steps of delivering from a first outlet a stream of droplets of a precursor liquid towards a substrate; applying an electric field between the first outlet and the substrate; and delivering from a second outlet a flow of fuel about the stream of droplets such as to provide an annular flame combustion region between the first outlet and the substrate through which at least a portion of the stream of droplets passes before reaching the substrate, whereby the precursor liquid is chemically reacted, or decomposed, or chemically reacted and decomposed, to provide the deposited material. Nor does such a combination provide an apparatus for depositing material on a substrate, comprising: a nozzle assembly including a first outlet from which a stream of droplets of a precursor liquid is in use delivered to a substrate, and a second outlet from which a flow of fuel is in use delivered such as to provide an annular flame combustion region through which at least a portion of the stream of droplets in use passes before reaching the substrate; a precursor supply for supplying a precursor liquid to the nozzle assembly; an electrical supply for applying an electric field between the first outlet and the substrate; and a burner for generating the flame of the annular flame combustion region between the first outlet and the substrate; whereby the precursor liquid is chemically reacted, or decomposed, or chemically reacted and decomposed, in the annular flame combustion region to provide the deposited material. Specifically, the rejection relies on Blackwell *et al.* as disclosing the generation of an annular flame combustion region. Applicants respectfully assert that this is not a correct reading of Blackwell *et al.*

The March 5, 2002 Office Action stated that Choy *et al.* does not show, "generating a flame from a burner coaxial with the droplet outlet," and that Blackwell *et al.* shows, "combustion processes and apparatus for atomized liquid reactants wherein atomization can be done electrostatically." Office Action at 3. Additionally, the Office Action continues that while Choy *et al.* does not show the claimed sequence of annual gas jets," Blackwell *et al.* shows the "use of inert shield gas between liquid precursor droplets and an outer, annular fuel gas jet." Office Action at 4.

The Examiner was apparently alleging that fuel is delivered through an annular channel, namely, the outermost channel (47), and, as such, the flame combustion region (23) must necessarily be annular. It is submitted that this allegation has no basis.

While the Office Action was correct in stating that Blackwell *et al.* shows combustion processes, it was respectfully submitted that these combustion processes do not include the annular fuel gas jet alleged in the Office Action.

Rather, Blackwell *et al.* demonstrates the use of a single or multi-jet fuel source which gives rise to a single, continuous flame area. The Examiner was respectfully invited to review figures 2-4 of Blackwell *et al.*, especially figure 4, which demonstrates that the burner (40) includes a number of concentric channels, but that the concentric channels provide a single, continuous flame area, not an annular flame combustion region as stated in the claims of the present invention.

In response to Appellant's comments, the November 12, 2002 Office Action alleged that the disclosure of Figure 4 incorrectly represents the flame combustion region (23) and that the shape of the flame in Figure 4 could not be relied upon. Specifically, the Office Action alleged that fuel is delivered through an annular channel, namely, the outermost channel (47), and, as such, the flame combustion region (23) must necessarily be annular. It is respectfully submitted that this allegation has no basis.

As Appellants stated in the May 12, 2003 Response (which was accompanied by a Request for Continued Examination) Appellants acknowledge that Blackwell *et al.* discloses the delivery of fuel through an annular outlet, this being the outlet defined by the outermost channel (47), but the outermost channel (47) is a frusto-conical channel and not a cylindrical channel. Blackwell *et al* makes no disclosure of the channels (43-47) being cylindrical channels as alleged by the Office Action, but rather that the channels (43-47) are concentric (column 9, lines 6 and 7). Concentricity merely defines that the channels (43-47) have a common center. The outermost channel (47), in being a frusto-conical channel, manifestly cannot provide for the generation of an annular flame combustion region as alleged in the Office Action.

In this regard, it is submitted that the teaching of Figure 4 is quite clear, in disclosing the generation of a single, continuous flame combustion region (23) from a frusto-conical channel (47). There is nothing in the teaching of Blackwell *et al.* to suggest that Figure 4 incorrectly represents the flame combustion region (23). On the contrary, the inwardly-directed frusto-

conical channel (47) as embodied can only provide a single, continuous flame combustion region (23), and, as such, the representation of Figure 4 is submitted to be accurate. Indeed, given that the purpose of the flame combustion region (23) is to provide a conversion site for converting the precursor material into soot particles at the burner face (53) (column 9, lines 13 to 16), it is submitted that the provision of other than a single, continuous flame combustion region (23) would not achieve this purpose. The Examiner is manifestly impermissibly performing a hindsight analysis of the prior art in attempting selectively to disregard the teaching of Figure 4 of Blackwell *et al.*

In support of this allegation, the Office Action is relying on the disclosure at column 9, lines 17 to 20, which discloses that "An inert gas, ... is delivered through channel 44 to inhibit reaction of liquid feedstock and soot build-up on burner face 53." The Office Action considers this disclosure to support his allegation that the flame combustion region (23) is away from the burner face (53), and apparently in an annular region defined by the outermost channel (47).

It is, however, submitted that this teaching referenced in the Office Action in fact contrarily demonstrates that the flame combustion region (23) extends across the burner face (53), particularly the central region thereof which includes the atomizer (41) from which feedstock is delivered. The purpose of delivering an inert gas through an inner channel, namely, inner channel (44), is expressly recited as being to "inhibit reaction of the liquid feedstock and soot build-up on burner face (53)." It is submitted that such inhibition at the burner face (53) is required for the very reason that the flame combustion region (23) extends thereover, as, otherwise, inhibition would be unnecessary, and, as such, and contrary to the Office Action's allegation, this disclosure is not to the development of an annular flame combustion region (23).

The Examiner is further alleging that the applicant has failed to identify any teaching in Blackwell *et al.*, other than the representation of the flame combustion region (23) in Figure 4, that the flame combustion region (23) is a single, continuous region.

Notwithstanding that the identification of any further teaching should not be required, given the clear disclosure of Figure 4, the applicant has already identified further clear teaching in Blackwell *et al.* to the flame combustion region (23) being a single, continuous region.

As set out hereinabove, the outermost channel (47) is an inwardly-directed frusto-conical channel, and such an inwardly-directed frusto-conical channel (47) as embodied can only provide a single, continuous flame combustion region (23). The generation of a single,

continuous flame combustion region (23) results from the outermost channel (47) being a frusto-conical channel.

Indeed, Blackwell *et al.* further discloses (column 8, line 67 to column 9, line 3) that the atomizer (41) "injects very finely atomized liquid reactant particles **into** flame 23." For such injection to occur into the flame combustion region (23), the flame combustion region (23) has to extend over the atomizer (41), and, as such, the flame combustion region (23) cannot be annular as alleged by the Office Action.

Furthermore, Blackwell *et al.* discloses (column 9, lines 13 to 17) that "The area proximate to the burner face 53 and flame 23 thus acts as a conversion site for converting liquid projections 42 into soot reactant particles." As the liquid projections (42) are created at the outlet of the atomizer (41), and the flame combustion region (23) is required to act as the conversion site for converting the liquid projections (42) into soot reactant particles, and the conversion site is required to be proximate the burner face (53), the flame combustion region (23) manifestly has to extend over the atomizer (41), and, as such, cannot be annular as alleged in the Office Action. If the flame combustion region (23) were annular as alleged in the Office Action, the stated conversion of the liquid projections (42) would manifestly not occur proximate the burner face (53).

The June 9, 2003 Office Action maintained the previous rejection, and again reiterated the opinion that Blackwell *et al.* teaches an annular flame region.

Appellants presented arguments in the December 9, 2003 Response again stating that Blackwell et al. does not describe an annular flame combustion region, as discussed herein above.

Again, Applicants acknowledge that Blackwell *et al.* discribes the delivery of fuel through an annular outlet, this being the outlet defined by the outermost channel (47), but the outermost channel (47) is a frusto-conical channel and not a cylindrical channel. Blackwell *et al.* makes no disclosure of the channels (43-47) being cylindrical channels as alleged by the Examiner, but rather the channels (43-47) are concentric (column 9, lines 6 and 7). Concentricity merely defines that the channels (43-47) have a common center, and is not necessarily indicative of an annular flame combusion region. Furthermore, and perhaps most importantly, the outermost channel (47), in being a frusto-conical channel, manifestly cannot provide for the generation of an annular flame combustion region as alleged by the Examiner.

Furthermore, the Examiner again alleged that the disclosure of Figure 4 of Blackwell *et al.* incorrectly represents the flame combustion region (23), and cannot be relied upon. Appellants respectfully disagree, and maintain that Figure 4 is not ambiguous; the flame depicted in Figure 4 is clearly drawn as a continuous flame.

In this regard, it is submitted that the teaching of Figure 4 is quite clear, in disclosing the generation of a single, continuous flame combustion region (23) from a frusto-conical channel (47). There is nothing in the teaching of Blackwell *et al.* to suggest that Figure 4 incorrectly represents the flame combustion region (23). On the contrary, the inwardly-directed frusto-conical channel (47) as embodied can only provide a single, continuous flame combustion region (23), and, as such, the representation of Figure 4 is submitted to be accurate. Indeed, given that the purpose of the flame combustion region (23) is to provide a conversion site for converting the precursor material into soot particles at the burner face (53) (column 9, lines 13 to 16), it is submitted that the provision of other than a single, continuous flame combustion region (23) would not achieve this purpose. The Examiner is manifestly impermissibly performing a hindsight analysis of the prior art in attempting selectively to disregard the teaching of Figure 4 of Blackwell *et al.*

Again, disregarding the arguments previously filed by Appellants, the Examiner further alleged that no teaching in Blackwell *et al.*, other than the representation of the flame combustion region (23) in Figure 4, had been pointed to by Appellants in demonstrating that the flame combustion region (23) of Blackwell *et al.* is a single, continuous region.

Notwithstanding that the identification of any further teaching should not be required, given the clear disclosure of Figure 4, the applicant has already identified further clear teaching in Blackwell *et al* to the flame combustion region (23) being a single, continuous region.

Firstly, as set out hereinabove, the outermost channel (47) is an inwardly-directed frusto-conical channel, and such an inwardly-directed frusto-conical channel (47) as embodied can only provide a single, continuous flame combustion region (23). The generation of a single, continuous flame combustion region (23) results from the outermost channel (47) being a frusto-conical channel.

Secondly, Blackwell *et al.* further discloses (column 8, line 67 to column 9, line 3) that the atomizer (41) "injects very finely atomized liquid reactant particles **into** flame 23" (emphasis added). For such injection to occur into the flame combustion region (23), the flame combustion

region (23) has manifestly to extend over the atomizer (41), and, as such, cannot be annular as alleged by the Examiner.

Thirdly, Blackwell *et al.* discloses (column 9, lines 13 to 17) that "The area proximate to the burner face 53 and flame 23 thus acts as a conversion site for converting liquid projections 42 into soot reactant particles.". As the liquid projections (42) are created at the outlet of the atomizer (41), and the flame combustion region (23) is required to act as the conversion site for converting the liquid projections (42) into soot reactant particles, and the conversion site is required to be proximate the burner face (53), the flame combustion region (23) manifestly has to extend over the atomizer (41), and, as such, cannot be annular as alleged by the Examiner. If the flame combustion region (23) were annular as alleged by the Examiner, the stated conversion of the liquid projections (42) would manifestly not occur proximate to the burner face (53).

Fourthly, the disclosure at column 9, lines 17 to 20, which discloses that "An inert gas, ... is delivered through channel 44 to inhibit reaction of the liquid feedstock and soot build-up on burner face 53", demonstrates that the flame combustion region (23) extends across the burner face (53), particularly the central region thereof which includes the atomizer (41) from which feedstock is delivered. The purpose of delivering an inert gas through an inner channel, namely, inner channel (44), is expressly recited as being to "inhibit reaction of the liquid feedstock and soot build-up on burner face 53." It is submitted that such inhibition at the burner face (53) is required for the very reason that the flame combustion region (23) extends thereover, as, otherwise, inhibition would be unnecessary.

Furthermore, the Examiner still alleges that a person skilled in the art would have been motivated to modify the apparatus and method of Choy *et al.* in accordance with the teaching of Blackwell *et al.* to utilize a combustion flame as the heating means for converting the precursor material.

Appellants maintain that a person skilled in the art would manifestly not have been so motivated, and at no time has the applicant acquiesced to the Examiner's allegation in this regard.

Choy *et al.* is directed to an apparatus and method which requires an increasing temperature gradient between the outlet (5) and the substrate (14), as disclosed in the summary of the invention at page 1, lines 22 to 30, particularly lines 29 and 30. It is important to recognize that Choy *et al.* does not merely require that an increased temperature be maintained

between the outlet (5) and the substrate (14), but rather that an increasing temperature gradient be provided, and more specifically that the increasing temperature gradient be such that the precursor material undergoes de-composition and/or chemical reaction on or in very close proximity to the surface of the substrate (14), as summarized at page 8, lines 22 to 31. The provision of such a heating regime represents the main thrust of the teaching of Choy *et al.*, and, indeed, is disclosed at, for example, page 7, lines 22 and 23 as being the principle of the deposition technique of Choy *et al.*

Given that the teaching of Choy *et al.* is to a deposition technique which essentially requires such a heating regime, it is submitted that a person skilled in the art would have had no possible motivation to contemplate modifying the apparatus or method of Choy *et al.* in a manner which would have been contrary to the very teaching thereof, that is, to provide a heating regime which did not provide an increasing temperature gradient from the outlet (5) to the substrate (14), but contrarily provided for conversion of the precursor material at the outlet (5) and away from the substrate (14).

This notwithstanding, the applicant maintains that Blackwell *et al.* does not disclose the generation of an annular flame combustion region as alleged by the Examiner.

In summary, it is submitted that a person skilled in the art would not have contemplated modifying the apparatus or method of Choy *et al.* in accordance with the teaching of Blackwell *et al.* to utilize a combustion flame, and, notwithstanding any such modification of Choy *et al.*, the claimed invention is clearly distinguished over the disclosures of Choy *et al.* and Blackwell *et al.* when taken in combination.

Furthermore, there is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at the recitations of claims 30-44 and 46-56.

Claim 30 introduces the recitation that the chemical reaction, or the decomposition, or the chemical reaction and decomposition, occurs in a higher temperature overlap zone between the stream of droplets and the annular flame combustion region. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 31 introduces the recitation that the flow of fuel is a diverging flow. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 32 introduces the recitation that the first and second outlets are coaxial. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 33 introduces the recitation that the stream of droplets is provided as a diverging spray. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 34 introduces the additional step of delivering a flow of cold gas in a direction from the first outlet towards the substrate. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 35 introduces the recitation that the flow of cold gas is delivered from a third outlet as a flow about the stream of droplets and within the flow of fuel. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 36 introduces the recitation that the first and third outlets are coaxial. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 37 introduces the recitation that the material is a ceramic material. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 38 introduces the recitation that the material is a multicomponent oxide material. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 39 introduces the additional step of heating the substrate. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 40 introduces the recitation that the precursor liquid is a sol precursor solution. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 41 introduces the additional step of moving one or both of the substrate and the first outlet during deposition so as to deposit a three-dimensional structure as a series of

overlying layers. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 42 introduces the additional step of controlling a region of deposition by varying one or more of a rate of flow of the fuel, a separation between the first outlet and the substrate and the electric field between the first outlet and the substrate. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 43 introduces the recitation that the material is deposited as a powder and the chemical reaction, or the decomposition, or the chemical reaction and decompostion, occurs away from the substrate. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 44 introduces the recitation that the material is deposited as a solid film and the chemical reaction, or the decomposition, or the chemical reaction and decomposition, occurs in the vicinity of the substrate. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 46 introduces the recitation that the chemical reaction, or the decomposition, or the chemical reaction and decompostition, occurs in a higher temperature overlap zone between the stream of droplets and the annular flame combustion region. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 47 introduces the recitation that the first and second outlets are coaxial. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 48 introduces the recitation that the nozzle assembly further comprises a third outlet disposed between the first and second outlets from which a flow of cold gas is in use delivered. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 49 introduces the recitation that the first and third outlets are coaxial. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 50 introduces the recitation that the first outlet is a central outlet. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 51 introduces the additional component of a mesh disposed between the first outlet and the substrate. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 52 introduces the additional component of an electrode at an electric potential between the potential of the first outlet and the substrate and disposed between the first outlet and the substrate. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 53 introduces the recitation that the electrode is an annular electrode. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 54 introduces the additional component of a positioner for altering the relative position of the first outlet and the substrate. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 55 introduces the additional recitation that the apparatus is configured such that the chemical reaction, or the decomposition, or the chemical reaction and decomposition, occurs away from the substrate so as to provide the material as a powder. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

Claim 56 introduces the additional recitation that the apparatus is configured such that the chemical reaction, or the decomposition, or the chemical reaction and decomposition, occurs in the vicinity of the substrate so as to provide the material as a solid film. There is no teaching, suggestion, or motivation in the art to modify Choy *et al.* and Blackwell *et al.* to arrive at this recitation.

CONCLUSION

For the reasons discussed in this brief and the arguments of record (incorporated herein by reference), claims 29-56 are patentable over Choy *et al.* (WO 97/21848) in view of Blackwell *et al.* (US 6,312,656). It is, therefore, respectfully submitted that the Examiner erred in rejecting claims 29-56, and a reversal of the rejection of claims 29-56 by this Honorable Board, and prompt issuance of a Notice of Allowance, are earnestly solicited.

Respectfully submitted,

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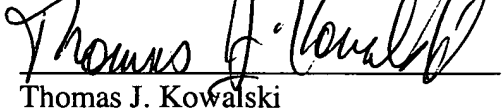
By: 

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APPENDIX A

Currently Pending Claims:

29. A method of depositing material on a substrate, comprising the steps of:

delivering from a first outlet a stream of droplets of a precursor liquid towards a substrate;

applying an electric field between the first outlet and the substrate; and

delivering from a second outlet a flow of fuel about the stream of droplets such as to provide an annular flame combustion region between the first outlet and the substrate through which at least a portion of the stream of droplets passes before reaching the substrate, whereby the precursor liquid is chemically reacted, or decomposed, or chemically reacted and decomposed, to provide the deposited material.

30. The method according to claim 29, wherein the chemical reaction, or the decomposition, or the chemical reaction and decomposition, occurs in a higher temperature overlap zone between the stream of droplets and the annular flame combustion region.

31. The method according to claim 29, wherein the flow of fuel is a diverging flow.

32. The method according to claim 29, wherein the first and second outlets are coaxial.

33. The method according to claim 29, wherein the stream of droplets is provided as a diverging spray.

34. The method according to claim 29, further comprising the step of:

delivering a flow of cold gas in a direction from the first outlet towards the substrate.

35. The method according to claim 34, wherein the flow of cold gas is delivered from a third outlet as a flow about the stream of droplets and within the flow of fuel.

36. The method according to claim 35, wherein the first and third outlets are coaxial.

37. The method according to claim 29, wherein the material is a ceramic material.

38. The method according to claim 29, wherein the material is a multicomponent oxide material.

39. The method according to claim 29, further comprising the step of:
heating the substrate.

40. The method according to claim 29, wherein the precursor liquid is a sol precursor solution.

41. The method according to claim 29, further comprising the step of:
moving one or both of the substrate and the first outlet during deposition so as to deposit a three-dimensional structure as a series of overlying layers.

42. The method according to claim 29, further comprising the step of:
controlling a region of deposition by varying one or more of a rate of flow of the fuel, a separation between the first outlet and the substrate and the electric field between the first outlet and the substrate.

43. The method according to claim 29, wherein the material is deposited as a powder and the chemical reaction, or the decomposition, or the chemical reaction and decompostion, occurs away from the substrate.

44. The method according to claim 29, wherein the material is deposited as a solid film and the chemical reaction, or the decomposition, or the chemical reaction and decomposition, occurs in the vicinity of the substrate.

45. An apparatus for depositing material on a substrate, comprising:

a nozzle assembly including a first outlet from which a stream of droplets of a precursor liquid is in use delivered to a substrate, and a second outlet from which a flow of fuel is in use delivered such as to provide an annular flame combustion region through which at least a portion of the stream of droplets in use passes before reaching the substrate;

a precursor supply for supplying a precursor liquid to the nozzle assembly;

an electrical supply for applying an electric field between the first outlet and the substrate; and

a burner for generating the flame of the annular flame combustion region between the first outlet and the substrate;

whereby the precursor liquid is chemically reacted, or decomposed, or chemically reacted and decomposed, in the annular flame combustion region to provide the deposited material.

46. The apparatus according to claim 45, wherein the chemical reaction, or the decomposition, or the chemical reaction and decompostition, occurs in a higher temperature overlap zone between the stream of droplets and the annular flame combustion region.

47. The apparatus according to claim 45, wherein the first and second outlets are coaxial.

48. The apparatus according to claim 45, wherein the nozzle assembly further comprises a third outlet disposed between the first and second outlets from which a flow of cold gas is in use delivered.

49. The apparatus according to claim 48, wherein the first and third outlets are coaxial.

50. The apparatus according to claim 45, wherein the first outlet is a central outlet.

51. The apparatus according to claim 45, further comprising:

a mesh disposed between the first outlet and the substrate.

52. The apparatus according to claim 45, further comprising:

an electrode at an electric potential between the potential of the first outlet and the substrate and disposed between the first outlet and the substrate.

53. The apparatus according to claim 52, wherein the electrode is an annular electrode.

54. The apparatus according to claim 45, further comprising:
a positioner for altering the relative position of the first outlet and the substrate.

55. The apparatus according to claim 45, where configured such that the chemical reaction, or the decomposition, or the chemical reaction and decomposition, occurs away from the substrate so as to provide the material as a powder.

56. The apparatus according to claim 45, where configured such that the chemical reaction, or the decomposition, or the chemical reaction and decomposition, occurs in the vicinity of the substrate so as to provide the material as a solid film.